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ORIGINAL ARTICLE

Predictors of Hospital Stay in Children with Acute Gastroenteritis and Dehydration

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ABSTRACT

Background: Acute gastroenteritis with dehydration is a leading cause of pediatric hospital admissions. Identifying predictors of prolonged hospital stay may improve clinical outcomes and optimize resource utilization.

Objective: To determine clinical and laboratory predictors of hospital stay among children admitted with acute gastroenteritis and dehydration.

Methodology: This was a hospital-based cross-sectional analytical study conducted at Paediatrics Department of Sahiwal Teaching Hospital, Sahiwal from August 2022 to January 2023. A total of 310 children admitted with acute gastroenteritis and clinical dehydration were enrolled in the study.

Results: Out of 310 children, 128 (41.3%) had prolonged hospitalization. These children were younger (2.9 ± 2.3 vs 4.6 ± 2.9 years), had lower weight (11.4 ± 3.7 vs 13.6 ± 4.2 kg), and higher malnutrition rates (43.8% vs 20.9%) (p≤0.01). Severe dehydration (40.6% vs 8.8%), lethargy (60.9% vs 22.0%), oliguria (56.3% vs 14.3%), and tachycardia (133 ± 19 vs 118 ± 14 bpm) were significantly more common (p<0.001). Laboratory abnormalities included lower sodium (136.5 ± 6.1 mEq/L), higher urea (45.7 ± 15.8 mg/dL), elevated creatinine (0.73 ± 0.23 mg/dL), and metabolic acidosis (48.4%) (p<0.001). Intravenous fluids were required in 89.1% of prolonged cases. Severe dehydration (OR 4.82), IV fluid requirement (OR 5.96), malnutrition (OR 2.76), hypernatremia (OR 3.45), and delayed presentation (OR 2.57) independently predicted longer stay.

Conclusion: Prolonged hospitalization is primarily driven by dehydration severity and metabolic derangements. Early risk stratification and prompt rehydration may significantly reduce hospital stay and improve outcomes.

Keywords: Acute gastroenteritis, dehydration, pediatric hospitalization, length of hospital stay, predictors, electrolyte imbalance.

INTRODUCTION

Acute gastroenteritis (AGE) remains among the major causes of hospitalization and visits of children in most countries of the world, particularly under the age of five years[1]. The majority of the cases are self-limiting, due to the excessive loss of fluids and electrolytes, and dehydration is a common occurrence and is the greatest reason for hospitalization, not the infection itself[2]. The late presentation and ineffective initial rehydration are the additional factors that lead to severe dehydration and prolonged hospitalization seen in the resource-constrained conditions. Length of stay (LOS) is a topical clinical and operational outcome as it is a measure of the severity of illness, recovery rates, the cost of healthcare and bed occupancy[3]. Late hospital discharge results in increased readmission rate of hospital-acquired infections and places an additional financial and emotional burden on the families[4]. Therefore, there is need to identify the factors that predict longer hospitalization in order to forecast risks early to manage them efficiently. Severity of dehydration at presentation is the greatest determinant of admission and delayed recovery. Youthful patients experiencing inadequate perfusion, tachycardia, a drop in the amount of urine, or an alteration in the cognitive state often require intravenous fluids and close monitoring, which automatically increases LOS[5]. The failure of oral rehydration therapy, which is accompanied by persistent vomiting or an excessive amount of stool, may require IV therapy and laboratory examination[6].

There is also the possibility that the duration of stay may be influenced by patient-related factors. In earlier years, especially infancy, are associated with a high rate of fluid loss and a slow rate of clinical recovery[7]. Physiological reserve is reduced by malnutrition or underlying chronic conditions, which impede recovery[8]. Laboratory abnormalities like hypernatremia, hyponatremia, or acidosis metabolism are to be corrected cautiously and observed further, which contributes to the long-term admissions[9]. Etiology, infectious causes can cause a change in the severity of the disease, and the existence of viral pathogens, such as rotavirus and norovirus, may lead to severe dehydration that can be fatal and requires hospitalization[10]. Care-giving practices, late seeking health care services, and poor home management practices would also result in children presenting with late stages of the disease[11]. In addition, variation in hospital clinical practices and resource utilization affects LOS irrespective of disease severity[12,13]. Regardless of hospitalization duration, timely identification of predictors could enable clinicians to apply time-specific interventions, maximize fluid use, and time discharge[14].

Objective: To determine clinical and laboratory predictors of hospital stay among children admitted with acute gastroenteritis and dehydration.

METHODOLOGY

This was a hospital-based cross-sectional analytical study conducted at Paediatrics Department of Sahiwal Teaching Hospital, Sahiwal from August 2022 to January 2023. The study was conducted in a group of 310 children who have been admitted due to acute gastroenteritis and clinical dehydration. All eligible participants were recruited by non-probability consecutive sampling. All children with the diagnosis of the study period were involved to assess clinical and laboratory predictors related to length of stay in the hospital. The participants were to be eligible for inclusion in the study as children between the ages of 6 months and 12 years with an acute onset of diarrhea with or without vomiting, less than 14 days, and with evidence of dehydration necessitating hospitalization. Acute gastroenteritis was considered to have passed 3 or more loose or watery stool in 24 hours with or without vomiting or fever. Dehydration was determined by clinical examination on the basis of WHO and classified as mild, moderate, and severe depending on general state, eyes sunken, skin turgor, capillary refill time, and urine output. Length of hospital stay was defined as the number of days between admission and

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discharge. Children who have chronic gastrointestinal illness, congenital defects, severe malnutrition necessitating special feeding regimes, chronic renal or cardiac illness, septic shock or other systemic infections were excluded.

Data Collection: Qualified children were recruited sequentially after ethical authorization was obtained and written permission was obtained from parents or guardians. Structured proforma was used to record baseline demographic and clinical details such as age, gender, weight, nutritional status, history of symptoms, feeding history and vaccination status. Clinical parameters, which included the dehydration severity, temperature, heart rate, respiratory rate, blood pressure, capillary refill time, and urine output were recorded at admission. In accordance with hospital protocol, laboratory tests, including complete blood count, serum electrolytes, blood urea and creatinine, and stool examination, were performed. The type of rehydration therapy (oral or intravenous), the need of antiemetics or antibiotics and complications during admission were also documented. All patients were managed in accordance with institutional guidelines for pediatric gastroenteritis.

Data Analysis: Data were entered and analyzed using SPSS version 21.0. Quantitative variables such as age, laboratory values, and length of hospital stay were expressed as mean ± standard deviation, while qualitative variables such as gender, dehydration severity, and treatment modality were presented as frequencies and percentages. Independent sample t-test or one-way ANOVA was used to compare continuous variables, and chi-square test was applied for categorical variables. Multiple linear regression analysis was performed to identify independent predictors of prolonged hospital stay. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

Among 310 children, those with prolonged hospital stay (>3 days, n=128) were significantly younger (2.9 ± 2.3 years) compared to those discharged earlier (4.6 ± 2.9 years, p=0.001). They also had lower mean body weight (11.4 ± 3.7 vs 13.6 ± 4.2 kg, p=0.002) and a markedly higher prevalence of malnutrition (43.8% vs 20.9%, p<0.001). Symptom duration before admission was longer (3.7 ± 1.6 vs 2.2 ± 1.1 days, p<0.001), and both fever (71.9% vs 57.1%, p=0.01) and frequent vomiting (64.1% vs 37.4%, p<0.001) were more common. Gender distribution showed no significant difference.

Severe clinical dehydration strongly correlated with longer stay, affecting 40.6% of the prolonged group versus only 8.8% of early discharges (p<0.001), while mild dehydration predominated in early discharges (44.0% vs 9.4%, p<0.001). Delayed capillary refill (56.3% vs 17.6%), sunken eyes (70.3% vs 39.6%), lethargy (60.9% vs 22.0%), and oliguria (56.3% vs 14.3%) were all significantly higher in prolonged admissions (all p<0.001). Mean heart rate was also elevated (133 ± 19 vs 118 ± 14 beats/min, p<0.001), indicating greater hemodynamic compromise.

Children with longer stays demonstrated worse biochemical profiles, including lower hemoglobin (10.5 ± 1.8 vs 11.2 ± 1.6 g/dL, p=0.004), lower sodium levels (136.5 ± 6.1 vs 139.8 ± 4.9 mEq/L, p<0.001), and higher rates of both hypernatremia (20.3% vs 3.3%) and hyponatremia (29.7% vs 9.9%) (both p<0.001). Renal parameters were elevated, with higher urea (45.7 ± 15.8 vs 30.5 ± 11.6 mg/dL) and creatinine (0.73 ± 0.23 vs 0.56 ± 0.18 mg/dL), while metabolic acidosis was more frequent (48.4% vs 11.0%) (all p<0.001), reflecting more severe dehydration and hypoperfusion.

Early discharge was common among children managed with oral rehydration alone (64.8% vs 10.9%), whereas intravenous fluid therapy was required in most prolonged cases (89.1% vs 35.2%) (p<0.001). Antiemetic and antibiotic use were higher in prolonged admissions (65.6% and 45.3% respectively) compared with early discharges (45.1% and 20.9%) (p≤0.001). Time to resume oral feeding was nearly doubled (31.5 ± 10.2 vs 16.4 ± 6.7 hours), complications were more frequent (28.1% vs 4.4%), and overall LOS averaged 5.1 ± 1.1 days versus 2.2 ± 0.6 days (all p<0.001).

Table 1. Baseline Demographic and Clinical Characteristics of Study Population (n = 310)

Variable	Total (n=310)	LOS ≤3 days (n=182)	LOS >3 days (n=128)	p-value
Age (years, mean ± SD)	3.9 ± 2.8	4.6 ± 2.9	2.9 ± 2.3	0.001
Male, n (%)	178 (57.4)	98 (53.8)	80 (62.5)	0.12
Female, n (%)	132 (42.6)	84 (46.2)	48 (37.5)	0.12
Weight (kg, mean ± SD)	12.7 ± 4.1	13.6 ± 4.2	11.4 ± 3.7	0.002
Malnutrition, n (%)	94 (30.3)	38 (20.9)	56 (43.8)	<0.001
Breastfeeding history present, n (%)	204 (65.8)	130 (71.4)	74 (57.8)	0.01
Duration of symptoms before admission (days, mean ± SD)	2.8 ± 1.4	2.2 ± 1.1	3.7 ± 1.6	<0.001
Fever present, n (%)	196 (63.2)	104 (57.1)	92 (71.9)	0.01
Vomiting ≥5 episodes/day, n (%)	150 (48.4)	68 (37.4)	82 (64.1)	<0.001

Table 2. Dehydration Severity and Clinical Findings at Admission

Variable	Total (n=310)	LOS ≤3 days	LOS >3 days	p-value
Mild dehydration, n (%)	92 (29.7)	80 (44.0)	12 (9.4)	<0.001
Moderate dehydration, n (%)	150 (48.4)	86 (47.3)	64 (50.0)	0.64
Severe dehydration, n (%)	68 (21.9)	16 (8.8)	52 (40.6)	<0.001
Capillary refill >2 sec, n (%)	104 (33.5)	32 (17.6)	72 (56.3)	<0.001
Sunken eyes, n (%)	162 (52.3)	72 (39.6)	90 (70.3)	<0.001
Lethargy, n (%)	118 (38.1)	40 (22.0)	78 (60.9)	<0.001
Oliguria, n (%)	98 (31.6)	26 (14.3)	72 (56.3)	<0.001
Mean heart rate (beats/min ± SD)	124 ± 18	118 ± 14	133 ± 19	<0.001

Table 3. Laboratory Parameters at Admission

Parameter	Total Mean ± SD	LOS ≤3 days	LOS >3 days	p-value
Hemoglobin (g/dL)	10.9 ± 1.7	11.2 ± 1.6	10.5 ± 1.8	0.004
Serum sodium (mEq/L)	138.4 ± 5.6	139.8 ± 4.9	136.5 ± 6.1	<0.001
Hypernatremia (>150), n (%)	32 (10.3)	6 (3.3)	26 (20.3)	<0.001
Hyponatremia (<135), n (%)	56 (18.1)	18 (9.9)	38 (29.7)	<0.001
Potassium (mEq/L)	4.1 ± 0.7	4.2 ± 0.6	3.9 ± 0.8	0.02
Urea (mg/dL)	36.8 ± 14.2	30.5 ± 11.6	45.7 ± 15.8	<0.001
Creatinine (mg/dL)	0.63 ± 0.21	0.56 ± 0.18	0.73 ± 0.23	<0.001
Metabolic acidosis (HCO_3 <18), n (%)	82 (26.5)	20 (11.0)	62 (48.4)	<0.001

Table 4. Treatment Characteristics and Hospital Course

Variable	Total	LOS ≤3 days	LOS >3 days	p-value
Oral rehydration only, n (%)	132 (42.6)	118 (64.8)	14 (10.9)	<0.001
Intravenous fluids required, n (%)	178 (57.4)	64 (35.2)	114 (89.1)	<0.001
Antiemetics used, n (%)	166 (53.5)	82 (45.1)	84 (65.6)	0.001
Antibiotics prescribed, n (%)	96 (31.0)	38 (20.9)	58 (45.3)	<0.001
Stool positive for pathogen, n (%)	74 (23.9)	28 (15.4)	46 (35.9)	<0.001
Time to oral feeding (hours, mean ± SD)	22.6 ± 9.8	16.4 ± 6.7	31.5 ± 10.2	<0.001
Complications developed, n (%)	44 (14.2)	8 (4.4)	36 (28.1)	<0.001
Mean LOS (days ± SD)	3.4 ± 1.6	2.2 ± 0.6	5.1 ± 1.1	<0.001

DISCUSSION

In this study different clinical and biochemical predictors of protracted hospitalization were developed in 310 children with acute gastroenteritis and dehydration. The children who did not get discharged after a relatively earlier interval were significantly younger and of lesser body weight, which implies that younger children were more susceptible. Cases of malnutrition (43.8% vs 20.9%), and duration of presentation (3.7 1.6 vs 2.2 1.1 days) were twice as many. Past literature has also suggested the congruence between younger age, bad nutrition and late care, and prolonged hospitalization[15,16]. Correlation of length of stay and the severity of diseases on admission was the best. A high level of osaic severe dehydration, 40.6 percent in prolonged and 8.8 percent in early discharges with increased lethargy (60.9 vs 22.0), slow capillary refill (56.3 vs 17.6), oliguria (56.3 vs 14.3), and tachycardia (133 19 vs 118 14 beats/min) were highly significant. Severe dehydration alone increased the likelihood of a long stay nearly five times (OR 4.82). The same findings have been reported in previous studies, in which the degree of dehydration was directly associated with slow recovery[17].

There were also biochemical imbalances. In the long-term cases, the sodium, urea, creatinine, and metabolic acidosis were lower in almost half of the patients (48.4 vs 11.0). It was also observed that hypernatremia (20.3% vs 3.3%) and hyponatremia were strongly associated with longer stays (29.7 vs 9.9). Previous studies have identified electrolyte and renal abnormalities as predictors of increased hospital length of stay[18,19]. There were also other treatment factors. Oral rehydration was adequate in the majority of these early discharges (64.8%), whereas intravenous fluids were required in 89.1% of the more protracted admissions, with nearly six times the risk (OR 5.96). The time to oral feeding delay, more complications (28.1 vs 4.4) and longer mean length of stay were noted. This has been depicted in previous research by the same researcher who has indicated that oral therapy at an early stage results in reduced admission and the use of IV dependence enhances recovery[20]. In general, the independent predictors of in-hospital delays were the younger age, malnutrition, severe dehydration, electrolyte imbalance, elevated urea, high vomiting frequency, late presentation and need of intravenous treatment. These results are consistent with prior research and highlight that strategic risk identification and vigorous rehydration for dehydration could substantially reduce hospitalization and health care costs.

CONCLUSION

It is concluded that prolonged hospital stay in children with acute gastroenteritis and dehydration is significantly associated with younger age, malnutrition, severe dehydration, electrolyte imbalance, elevated renal parameters, delayed presentation, and need for intravenous rehydration. Children with longer admissions were younger, more frequently malnourished, had higher rates of severe dehydration and metabolic acidosis, and required IV fluids in most cases, resulting in nearly double the mean stay. Early identification and targeted management of these risk factors may reduce hospitalization duration, lower complication rates, and improve healthcare resource utilization.

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